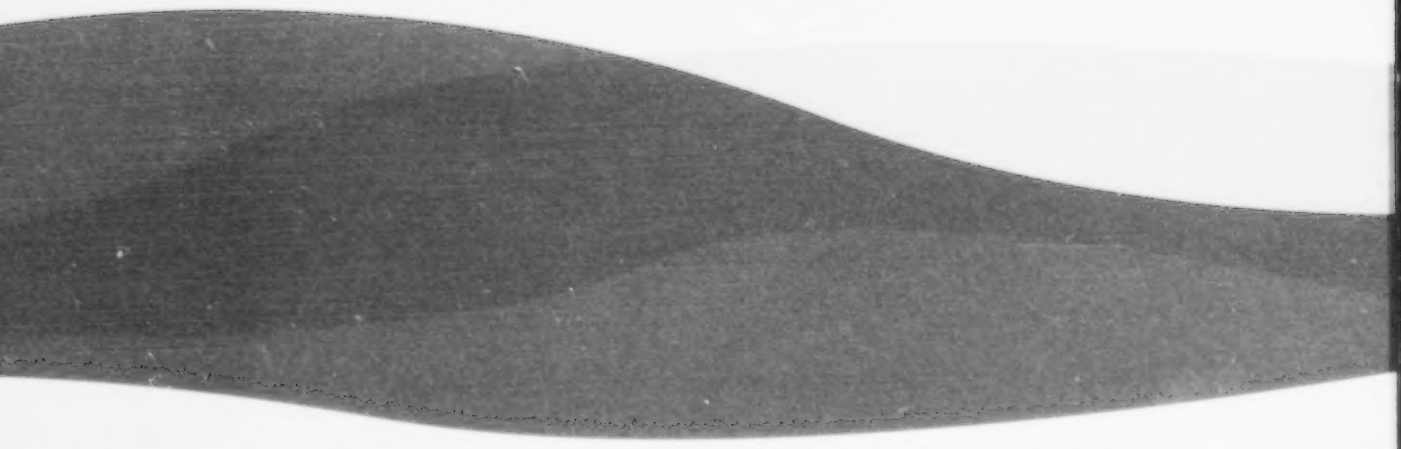
Final Report

August 2004



105-01762/

August 9, 2004

Honourable Lorne Taylor, Ph.D
Minister of Environment
Government of Alberta
423 Legislature Building
Edmonton, Alberta

Dear Dr. Taylor:

On behalf of the Advisory Committee on Water Use Practice and Policy, we are pleased to submit this report with recommendations that address the use of water for underground injection.

Overall, the committee process was very constructive, with tremendous input and effort put forward by all members. Ten meetings were held between October 7, 2003 and July 20, 2004 in which the committee attempted to fully understand the issues, practices, policies and options for change regarding underground injection. In finalizing its recommendations, the committee considered the input received on its preliminary report during the stakeholder consultation in April and May 2004.

Central to the discussions were the key directions outlined in *Water for Life* which include: the need for water conservation; healthy aquatic ecosystems; reliable, quality water supplies for a sustainable economy; sufficient knowledge to make sound water management decisions; and water management that focuses on watersheds. With respect to these principles, the committee believes there are significant opportunities to reduce or eliminate the use of non-saline water for underground injection, if a new regulatory process and other recommendations are implemented immediately. This new regulatory process should use a risk-based approach applied on a case-by-case basis. However, the committee was unable to determine specific reduction or elimination targets due to inadequate, basin-scale knowledge of water resources and water use, and without a detailed review of existing injection licences.

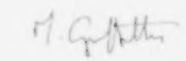
The committee encourages the Government of Alberta, with leadership from Alberta Environment, to accept these recommendations and facilitate their implementation without delay. There are immediate improvements that can be made; however, ongoing co-operation between industry, government and stakeholders will be key for long-term success.

We trust that you will find the report a useful contribution to the ongoing challenges of managing Alberta's water resources in the face of increasing economic and population growth, and scientific uncertainty about future supplies. The committee appreciates the opportunity afforded to it to provide advice on these matters.

Respectfully submitted – August 9, 2004

D. O. Trew
Chair

D. Pryce
Co-Chair



Dr. M. Griffiths
Co-Chair

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Executive Summary

Introduction

Concerns about water use for underground injection purposes arose during public discussions of *Water for Life: Alberta's Strategy for Sustainability* in 2002. Many Albertans identified the need for an increased emphasis on water conservation, some expressed specific concern about the use of water for underground injection activities.

A multi-stakeholder committee (the Advisory Committee on Water Use Practice and Policy, or "committee") was appointed by the Minister of Environment to review ways to improve the management of water related to underground injection. This committee has considered a wide range of information and viewpoints, and has concluded that additional measures are needed to protect Alberta's non-saline waters[1]. As part of a broader effort to conserve water, the committee believes a concerted effort must be made to reduce or eliminate, on a case-by-case basis, the use of non-saline water for underground injection.

The committee was aware of the concern that underground injection may remove water from the active water cycle. While the committee did not feel it was qualified to consider the significance of removing water from the hydrologic cycle, they did recognize that water used for underground injection is removed from a specific watershed. The committee therefore focused on policy and process changes to achieve conservation.

The *Water Act*, regulations and policies define the requirements for water use in Alberta, and also define the rights of licensed users. The committee encourages the interested reader to examine the complete report following this Executive Summary in order to get a full picture of water use and the policies and regulations that affect it.

Recommendations to Reduce or Eliminate Underground Injection of Non-Saline Water

The committee recommends a measured approach to achieving reductions in the underground injection of non-saline water that places the highest priority on areas where water scarcity is, or is likely to become, a concern to other water users or to environmental sustainability. The committee notes the urgent need to: improve groundwater information; change the process for assessing applications for diversion of non-saline water; and review existing water licences for underground injection purposes. The committee believes the proposed changes will result in significant non-saline water conservation improvements. Additional information gathered over the next three years will permit a clear schedule and targets to be set to promote longer-term opportunities for reduction or elimination.

The committee recommends the Government of Alberta adopt and facilitate the following actions, which fall under two broad categories:

- Initiatives to achieve significant reductions or elimination.
- Broader initiatives to improve water conservation.

[1] In this report the term "non-saline" water refers to water protected under the Water (Ministerial) Regulation and subject to regulatory controls and diversion/use applications. Non-saline is defined as water that has total dissolved solids (TDS) content of 4,000 milligrams per litre or less. This water can be used for a variety of purposes depending on the specific quality and whether or not it is treated. Only a portion of the water is considered to be "fresh" (suitable for human consumption); a larger portion may be used for livestock watering or domestic purposes.

Initiatives to Achieve Significant Reductions or Elimination

- Develop and implement a new province-wide regulatory process that will guide decisions, on a case-by-case basis, regarding the reduction or elimination in the use of non-saline water for underground injection projects. This new process must ensure specific limitations on the use of non-saline water sources. This will include the following changes:
  1. Extend the current process to apply to surface as well as groundwater, and to the forested area as well as the settled area of the province.
  2. Develop a "decision tree" with clear criteria (technical, environmental, social and economic) to guide applicants and identify the most stringent requirements, and the highest urgency for conservation, for potentially water-short areas of the province where other priority users (including the aquatic ecosystem) have a need for non-saline water.
  3. Determine priority locations within watersheds where every reasonable effort should be made to reduce or eliminate underground injection of non-saline water. This should be part of water management planning and should involve the stakeholders that share water resources in the region (e.g. watershed planning and advisory councils and/or stakeholder advisory committees).
- Evaluate economic instruments to support reductions in the use of non-saline water for underground injection.
- Review all *Water Act* term licences upon renewal using the new regulatory process to significantly reduce both the allocation granted by these licences, and the amount of non-saline water actually being used (i.e. replace non-saline water with saline water or alternate technologies).
- Review *Water Act* permanent licences that allow underground injection of non-saline water, in co-operation with the licence holders. Review any gaps between actual use of non-saline water and allocated volumes and work together to return any surplus allocations to the Crown. Also, assess permanent licences, using the new decision tree, to determine if there are any practical opportunities for reduction or elimination, especially in high priority areas. The committee notes the need to respect and be consistent with all holders of permanent licences but allocations for underground injection could develop surpluses as conventional oil production naturally declines. Economic and environmental criteria should guide identification of situations in which changes to eliminate or significantly reduce use of non-saline water are necessary and practical.
- Increase and improve water resources information to support comprehensive analysis and decision-making during planning and licensing processes. This will include the following changes:
  1. Increase the detail and the coverage of the provincial groundwater inventory, focusing on priority areas.
  2. Develop a more detailed water use reporting system and public information system that will allow Albertans to understand the state of their watersheds and aquifers, and to track the outcomes of the changes recommended by the committee.
  3. Invest in research (government-industry shared initiative) to support the implementation of new methods or technologies that will reduce the volumes of underground injection of non-saline water.

Broader Initiatives to Improve Water Conservation

The committee believes the initiative to reduce the use of non-saline water for underground injection should be part of the *Water for Life* strategy initiatives and should be co-ordinated with the conservation schedule set out in the strategy. Specifically, the committee recommends the following:

- Identify targets related to underground injection in the provincial Water Conservation Plan that addresses all water use sectors. Monitor and report the achievement of reductions in the use of non-saline water within provincial, watershed, and municipal boundaries.
- Review progress in 2007. The Government of Alberta should evaluate whether or not significant reduction in non-saline water use for underground injection has or is scheduled to occur. Following the review, the Government of Alberta and the Alberta Water Council should consider whether or not further measures and changes are needed to ensure progress toward water reduction targets is made.

Table 1 (page 7) provides a schedule for implementation, categorizing these actions into short, medium and long-term initiatives.

Identifying Specific Targets

The committee believes there are significant opportunities to reduce and eliminate the use of non-saline water for underground injection, on a case-by-case basis, if the new regulatory process is implemented immediately. However, specific targets cannot be established without adequate basin-scale knowledge of water resources and water use, and a review of existing injection licences.

The committee proposes initial targets be established in the next three years, following consolidation of new data. These initial targets should: indicate percentage reduction expected in non-saline water use; be location specific; provide timelines for these reductions; and identify efficiency targets (as proposed in the *Water for Life* strategy). All targets should be evaluated at regular intervals.

While all committee members acknowledge more specific and significant targets should result from this analytic approach, some committee members would prefer to declare a goal to eliminate the use of non-saline water for underground injection, starting in "water-short" areas–even if it is currently unclear how this goal could be achieved.

Table 1: Schedule to Reduce Use of Non-Saline Water for Underground Injection

Short-Term **In 1-3 years (2004-07)**	**Medium-Term** **In 4-7 years (2008-11)**	**Long-Term** **In 8-11 years (2012-15)**
Step 1 Actions **Initiate Reductions in Allocations and Use**	**Step 2 Actions** **Implement Efficiency/ Productivity Improvements**	**Step 3 Actions** **Achieve Conservation Targets Minimization/elimination**
Develop a new regulatory process (Water Allocation Policy and Guidelines, "decision tree") for use of non-saline water for underground injection. Amend Alberta Energy and Utilities Board (EUB) documents and synchronize approval processes with Alberta Environment.	Evaluate review process and determine if regulatory changes or further policy development are required. Identify and implement reductions in use of non-saline water for uses other than conventional ER by 2011 (e.g. salt cavern or deep well disposal uses).	Evaluate review process and determine if regulatory changes or further policy development are required.
Categorize licences and applications within each watershed using three risk-based levels or "tiers." Tier 1 = lower risk, Tier 3 = higher risk.	Implement tier-specific targets for reduction or elimination of underground injection of non-saline water. (Reduce or eliminate underground injection of non-saline water in Tier 3 areas.)	Overall improvement in productivity and efficiency in Tiers 1 and 2. Further reduction or elimination of underground injection of non-saline water in Tier 3 areas.
Review *Water Act* licences to identify opportunities for reductions in water allocations and use and make the reductions: - term and new licences, - permanent licences.	Ongoing licence reviews and continued use of new Guidelines.	Ongoing licence reviews and continued use of new Guidelines.
Ensure water management plans currently under development address the use of non-saline water for underground injection.	Water management planning should be initiated for all remaining basins and must address the use of non-saline water for underground injection. Ensure future allocations will not create water deficits or conflicts in these areas.	Water management plans are developed for the entire province, each containing recommendations specific to underground injection activities.
Ensure underground injection is addressed in the provincial Water Conservation Plan (30% productivity and efficiency target proposed by Water for Life, subject to evaluation by sector). Government of Alberta and Alberta Water Council (AWC) as the baseline year.	Implement Water for Life conservation plans: - Section by sector plans - Alberta Water Council and Government of Alberta to review plans.	Achieve agreed upon target improvements in productivity and efficiency (by 2015), province-wide, all sectors.
Evaluate economic instruments to reduce the use of non-saline water for underground injection. Address situations where energy resources may become stranded.	Implement economic instruments and/or incentives where appropriate. Address situations where energy resources may become stranded.	Measure effectiveness of economic tools and improve where required. Resolve situations where energy resources have become stranded.
Improve Alberta groundwater inventory. Develop and implement Water Use Reporting System and public reporting system.	Continue to improve Alberta groundwater inventory. Water Use Reporting System is operational. Public reporting system is operational.	Adequate groundwater information is available to support water management activities. Water use and public reporting systems used to verify achievements.
Increase research and development on alternative sources or recovery methods.	Continue industrial research and development.	Implement alternate facts (cogen) as appropriate including results of non-water research.
Alberta Environment to review progress in 2007 and evaluate whether or not significant reduction of underground injection of non-saline water has occurred. Identify any action required.	Review reduction and conservation targets and achievements in 2011 and identify any action required.	Review reduction and conservation targets and achievements in 2015 and identify any action required.

Introduction

Purpose of the Committee

The Advisory Committee on Water Use Practice and Policy (committee) was established in Fall 2003 to review the use of water for underground injection and identify options to reduce the amount of non-saline water used. The committee considered the following industrial activities:

- Deep well disposal of industrial wastewaters;
- Water used for creating salt caverns; and
- Water used for the enhanced recovery (ER) of oil and bitumen through water and steam injection processes.

As part of its work, the committee considered current information including: policy and approval processes; industrial practices; data and knowledge used as a basis for decisions about the use of water for underground injection purposes; and public and stakeholder input.

The recommendations in this report reflect the committee's support for accelerating water conservation gains in underground injection practices while respecting the rights and economic contributions of the operators who inject water underground for industrial purposes. These recommendations are summarized in Table 1 *(page 7, Executive Summary)*.

Background

Concerns about water use for underground injection purposes arose during public discussions of *Water for Life: Alberta's Strategy for Sustainability* in 2002. Many Albertans identified the need for an increased emphasis on water conservation, and some expressed specific concerns about the use of water for underground injection activities. The Minister of Environment appointed a multi-stakeholder committee (the committee) to review ways to improve the management of water related to underground injection.

The *Water Act*, regulations and policies define the requirements for water use in Alberta and also define the rights of licensed users. The committee recommends that all affected parties become well informed about the legal, environmental, technical, and economic considerations that define appropriate action in this situation. Ongoing communication among water users will help determine water conservation needs and thereby achieve expectations in each industrial sector.

The committee was aware of the concern that underground injection of water may remove water from the active water cycle. While they did not feel qualified to consider the significance of removing water from the hydrologic cycle, they did recognize that water used for underground injection is removed from a specific watershed. The committee therefore focused on policy and process changes to achieve conservation.

Public Outreach

In response to the concerns outlined above, the committee submitted a preliminary report to the Minister of Environment on March 31, 2004 that proposed a number of changes intended to address issues about underground injection of non-saline water. This report was released for public response, along with a questionnaire. The report included a number of recommendations for policy changes that were strongly supported by the 228 Albertans and stakeholder organizations who responded to the questionnaire. Many respondents advised the committee to include a specific goal to eliminate underground injection of water, and to establish specific targets to ensure significant progress is made toward this goal. Sectors using the water (and holding the water rights under discussion) advocated protecting water resources and the rights of other priority users, while enabling the continued development of Alberta's hydrocarbon resources with responsible use of non-saline water. This report considered the advice received during the public outreach process. A summary of the consultation results is included as Appendix 1.

Water Rights and Underground Injection

Current legislation does not limit or prioritize allocation on the basis of the specified use of the water. Rather, water rights are prioritized on the basis of time of application *(first-in-time, first-in-right)*. In Alberta, water licences have been issued to companies that inject non-saline water underground since the 1950s. Most of these licences are classified as *permanent* and allow the licence holder to continue using the water, in perpetuity, for the purposes intended. Other injection licences issued since the *Water Act* came in force in 1999 are considered *term* licences and either expire, or are renewable, at the end of a specified term (usually five years).

Overall, companies that are conducting underground injection of water are doing so within defined regulations and policy guidelines, and hold water licences and Alberta Energy and Utilities Board (EUB) approvals that give them specific rights and responsibilities. They have often made significant investments on the basis of the water rights they hold. The committee recognizes that changes in policy and industrial practices for underground injection of water will take time, given existing water rights and available technology. The committee also understands that co-operation from the companies that hold water licences is important to achieve reduction in this type of water use.

A Need for Conservation Improvements

The committee is making its recommendations after a detailed review of legislation, government policy, current industry practices, public input and information about the use of water for underground injection. The committee understands that regulators have made allocation decisions about underground injection with consideration for local water supplies, existing users and potential environmental impacts. The committee notes that the oil and gas sector has reduced non-saline water use over the past three decades. However, the committee feels that further efforts to improve conservation are warranted because of the increasing demand for water, water shortages in some areas, and uncertainties about long-term supply. The committee notes that more comprehensive data (particularly for groundwater availability) are needed to establish credible targets for reduction or elimination of the underground injection of non-saline water.

Guiding Principles

The committee believes the principles from *Water for Life* provide valuable guidance for water management in Alberta. The committee added the criteria noted below to provide more specific guidance in relation to decisions about underground injection of water.

Table 2

Water for Life Principles	Decisions about underground water injection should
All Albertans must recognize there are limits to the available water supply.	Minimize the volume of non-saline water used for underground injection.
Albertans must become leaders at using water more effectively and efficiently, and will use and reuse water wisely and responsibly.	Promote and support sustainable development practices.
	Allow transition times for affected sectors to avoid "economic shocks" and impractical technologies.
Citizens, communities, industry and government must share responsibility for water management in Alberta, and work together to improve conditions in their local watershed.	Respect the expectations of Albertans, who regard water as an important part of their heritage.
	Consider whether affected stakeholders and knowledgeable experts have been consulted and have had an opportunity to contribute their advice.
	Ensure fairness to all affected parties.
Knowledge of Alberta's water supply and quality is the foundation for effective decision-making.	Incorporate the best available knowledge and science, and note gaps or assumptions where improved information is needed.
	Recognize and build on past efforts.
Alberta must preserve the "first in time, first in right" principle for granting and administering water allocations, but water allocations will be transferable to ensure societal demands and needs can be met.	Create desirable outcomes for Albertans, including recognition of the benefits of industrial uses of water.
Healthy aquatic ecosystems are vital to a high quality of life for Albertans and must be preserved.	Consider both short-term and long-term effects on society and environment.
Groundwater and surface water quality must be preserved in pursuing economic and community development.	Minimize risks to human or environmental health by ensuring that monitoring and contingency response is in place for unpredictable future risks.

Information Considered by the Committee

Albertans are concerned about possible water supply shortfalls in some areas of the province. The committee recognizes that further efforts to reduce the use of non-saline water for underground injection are an important step toward conserving Alberta's water resources.

The committee also recognizes that Albertans benefit from income and royalties that accrue from the recovery of oil and bitumen through enhanced recovery (ER) methods (i.e. methods that commonly rely on injection of water or steam underground). The challenge is to achieve significant water conservation gains in a manner that is fair (i.e. respects the rights of water licence holders) without creating unacceptable economic impacts that could affect Albertans.

It was important for the committee to develop a common understanding of the available information as it pertains to ER practices, allocation principles, and actual water use. The following section briefly highlights some of the information the committee considered during its discussions.

Water Allocation in Alberta[2]

According to Alberta's *Water Act*, all industrial, municipal, large agricultural and other non-domestic water users must apply to Alberta Environment for a licence to divert and use an annual allocation of water. In Alberta, water is allocated on the principle of *first-in-time, first-in-right* for both surface and groundwater. This principle, which has existed since 1894, means that water diversions are prioritized according to the seniority of a licence, regardless of use (the older the licence, the higher the priority). Water licences are not prioritized on the basis of intended use.

Before an application to divert water is approved, Alberta Environment reviews it to ensure existing water users' rights are protected, that water is available to meet the needs of the applicant, and any potential impacts on water resources and aquatic ecosystems are minimized. This process applies to all licence applications for ER operations.

While water licences are not prioritized on the basis of use, household water use is considered to be a *statutory right* and therefore has the highest priority of all water diversions. Therefore, the water rights of domestic users cannot be superseded by any other use of water, regardless of licence priority.

Traditional agricultural users have statutory water rights and priority rights, which are based on their registration of use.

Where Has Alberta's Water Been Allocated?

Water is used for a variety of purposes in the province and Alberta Environment keeps records of all allocated water. These allocations are based on the expected maximum amount an applicant may require annually. Actual water use in any given year can be significantly less (but not more).

During 2001, Alberta allocated over 9.4 billion m³ of water. Surface water accounted for 98 per cent of total allocations and the remaining 2 per cent was groundwater. Water allocations by sector are illustrated in *Figure 1*.

Figure 1: Allocation by Specified Purpose

a Municipal
b Recreation
c Water Management
d Other Purpose Specified by the Director
e Wildlife Management
f Injection (Oil Recovery)
g Industrial (Oil, Gas, Petroleum)
h Drilling (Developing Oil Gas Wells)
i Commercial (Cooling)
j Agricultural
k Commercial
l Fish Management
m Habitat Enhancement
n Irrigation

For more information on hydrology in Alberta, refer to the presentations and fact books presented to the committee at: www.waterforlife.gov.ab.ca/html/removed.html

Environmental Considerations

As with all water uses, many Albertans have concerns about the possible effects to the environment and aquatic ecosystems. They want to be assured water is being used responsibly. *Water for Life* identifies key environmental goals essential to the maintenance of healthy aquatic ecosystems and safe, sustainable water supplies.

Development of sound policy and practices regarding underground injection of water must consider the following:

- Increased demand on water supplies caused by industrial, economic and population growth puts pressure on the natural environment.
- There is a fundamental variation in the water supply available from year to year and from place to place. This results from natural variability within the hydrologic cycle. There is uncertainty regarding the potential for effects on the available water supply, due to climate change in Alberta.
- Cumulative effects on surface and groundwater systems.
- The effects of underground injection activities on regional water sources.
- Water conservation, in all economic sectors, has been identified as a key initiative of *Water for Life*.

Water Allocation and Use in the Oil and Gas Sector

The report *Water Use for Injection Purposes in Alberta*[1] provided the most accurate water use information up to 2001. The committee used this, and allocation information from Alberta Environment, as the baseline for their discussions. More recent water use information is currently being verified.

Enhanced recovery (ER) processes increase the amount of oil produced. In most cases, water is injected underground into conventional wells to increase pressure and carry with it some of the

[1] Water Use for Injection Purposes in Alberta report, Alberta Environment, 2003. Available on the Internet at: www.waterforlife.gov.ab.ca/docs/geowa_report.pdf

remaining oil. Water can also be used to recover oil from oil sands through the injection of steam to heat and mobilize the crude bitumen. Note: water use at large, open-pit oil sands mining operations was not considered in the committee's review.

For 2001, the oil and gas sector was licensed to use 4.6 per cent of all water allocated in Alberta (Figure 1). Less than half of that amount (1.9 per cent) was allocated for ER processes.[1] By comparison, the agriculture sector (including irrigation) was licensed to use approximately 46 per cent, and municipal water supplies accounted for 11 per cent, none of which is injected underground. (Note: these percentages do not necessarily represent actual use or consumption trends.)

In 2001, a total of 276.4 million m^3 of water was injected for ER operations in Alberta. Of this total, 228.9 million m^3 (83 per cent) was re-injected saline water recovered naturally with oil from underground reservoirs (referred to as produced water). The remaining 47.5 million m^3 of water injected (17 per cent) was surface or groundwater (both saline and non-saline water) external to the oil reservoir (referred to as new *source water* or *"make up" water*).

Of this amount:

- 37.1 million m^3 (78.1 per cent) was from non-saline, or fresh, sources and
- 10.4 million m^3 (21.9 per cent) was saline water.

Of the 37.1 million m^3 of non-saline water injected:

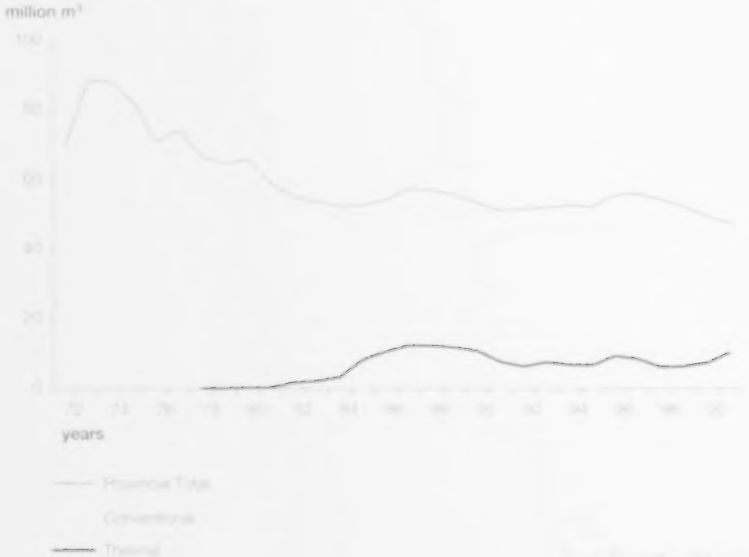
- 26.9 million m^3 (72.5 per cent) came from surface water sources, and
- 10.2 million m^3 (27.5 per cent) was sourced from groundwater.
- This amount used represents about 0.3 per cent surface water allocation and 5.5 per cent of groundwater, for a total of 0.4 per cent of water allocation in the province.

Water Use Trends for Underground Injection

Since the mid 1970s, the use of water for *conventional* underground injection activities has been declining in Alberta (Figure 2) due to improved water recycling efforts by industry, and a general decline in the remaining, recoverable conventional oil resource. However, overall water use in *thermal* recovery projects has increased.

[1] It should be noted that ER allocation represents 26.4 per cent of groundwater allocations because a relatively small amount of groundwater is formally allocated.

Figure 2: Source Water Diversion for Oilfield Injection – Total Source Water Used

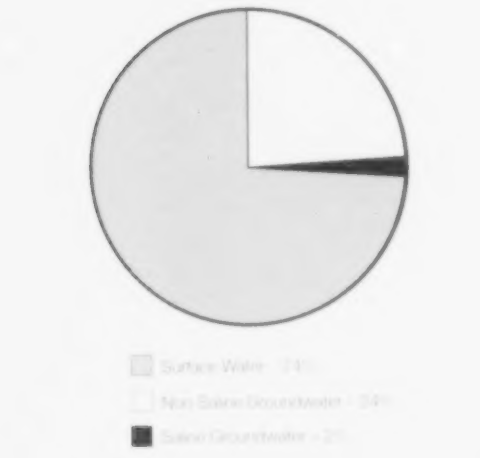


The total volume of source water used has declined from 69.5 million m^3 in 1972 to 47.5 million m^3 in 2001 (Figure 3).

Recent advances in technology have also enabled the use of some saline groundwater in steam generation processes as a portion of the total water needed. Overall, the use of saline groundwater has increased as a proportion of the total source water used in both conventional and thermal ER projects in Alberta (Figure 3).

The future trends in *thermal* and *conventional* water demands are illustrated in Figure 4. Source water required for conventional oil recovery will continue to decline[7], whereas water demand for thermal recovery operations will continue to grow. As explained earlier, an increasing portion of this water is expected to be from saline water sources.

Figure 3:
Source Water Diversion for Oilfield Injection


1972 Oilfield Injection Total Volumes
Source Water Total Diversion = 69,497,060 m³
Surface Water - 14%
Non Saline Groundwater - 24%
Saline Groundwater - 2%
2001 Oilfield Injection Total Volumes
Source Water Total Diversion = 47,525,748 m³
Surface Water - 57%
Non Saline Groundwater - 22%
Saline Groundwater - 21%

Preliminary data indicates total source water use for 2002 was 48.3 million m^3.

Many licence holders who hold allocations for conventional oil injection are likely to have significant surpluses within their allocations as oil field production diminishes.

Figure 4: Enhanced Oil Recovery – Total Source Water Use (Historical and Forecast)

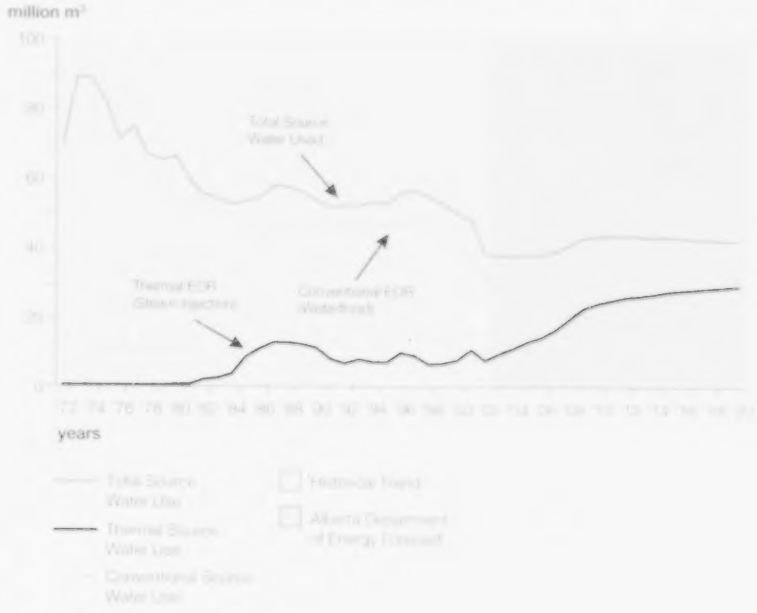
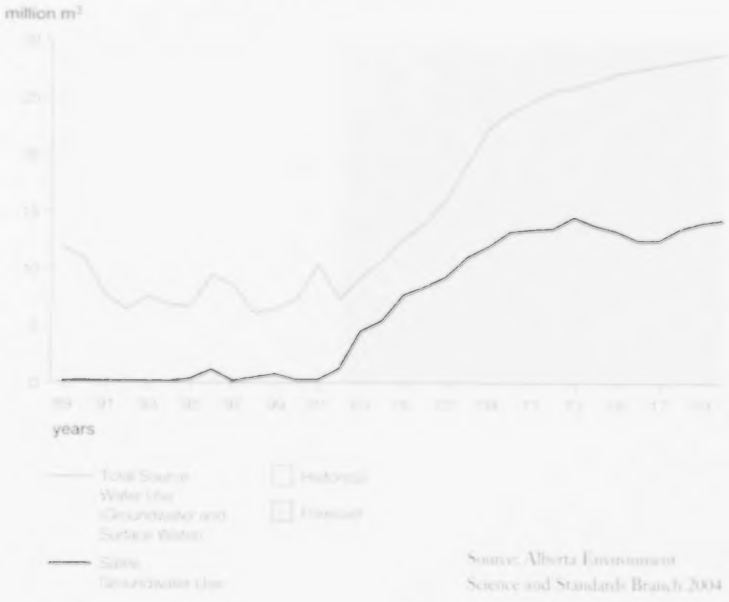


Figure 5: Future Water Use – Thermal EOR



Source: Alberta Environment Science and Standards Branch 2004

Further increases in saline water use are expected to occur at both new and existing thermal recovery projects. This may help reduce the potential need for non-saline surface and groundwater during development of Alberta's oil sands deposits *(Figure 5)*.

Economic Factors

More than 50 per cent of Alberta's production of conventional light oil each year is now supplied by ER operations. In 2001, $447 million in direct royalties were generated from conventional and thermal ER activities. These royalties help to provide the funds needed to deliver core public programs in Alberta such as health, education and infrastructure.

The use of water in ER operations is currently the most common, and considered the most economic, practice used by industry.

Policies Related to Underground Injection of Non-Saline Water

There are a number of provincial policies and regulations regarding using water for underground injection:

Groundwater Allocation Policy for Oilfield Injection Purposes (Alberta Environment, 1990)
This policy encourages the use of saline groundwater for oilfield injection in conventional oil pools and emphasizes the protection of non-saline groundwater resources used for domestic and agricultural operations in the settled areas of the province (White Zone) – *see Figure 6.*

Figure 6: Alberta's White and Green Zones

Groundwater Evaluation Guideline (Alberta Environment, 2003)
This technical guideline specifies procedures and practices for evaluation and protection of groundwater resources. The guideline is used in preparation of *Water Act* applications (for licences to use non-saline groundwater in Alberta).

Guide 23 – Guidelines Respecting an Application for a Commercial Crude Bitumen Recovery and Upgrading Project (EUB, 1991)
This guideline sets out requirements and procedures needed to prepare an application for development of a commercial-scale oil sands mine or in-situ development using steam injection.

Guide 51 – Injection and Disposal Wells: Well Classifications, Completion, Logging, and Testing Requirements (EUB, 1994)
This guideline specifies waste classification requirements, well construction and monitoring requirements, and safety measures regarding the underground disposal of liquid industrial and oilfield wastes.

Guide 65 – Resources Applications for Conventional Oil and Gas Reservoirs (EUB, Revised 2003)
This guideline specifies procedures and industry practices required for licensing and operation of conventional oil and gas recovery operations in Alberta. This includes applications for ER using water flood methods.

IL 89-5 Water Recycle Guidelines and Water Information Reporting for In-Situ Oil Sands Facilities in Alberta (EUB, 1989)
This information letter outlines government expectations, objectives and requirements for recycling of water used in steam injection (for recovery of bitumen from oil sands deposits).

Recommendations

The committee emphasizes in its Guiding Principles that it is essential to protect both Alberta's water resources and the rights of water licence holders. The committee feels it is important to reduce underground injection of non-saline water in this province as part of an overall commitment to conserve water.

The committee recommends changes in the regulatory process to ensure increased emphasis on water conservation and increased assurance that non-saline water sources are protected. Recognizing the rights of licence holders, and the changes in policy and technology required, the committee recommends an orderly reduction process that incorporates economic and environmental considerations. This decision process would include a review of each licence that currently allocates non-saline water for underground injection.

The committee proposes a 10-year schedule to reduce or eliminate the use of non-saline water for underground injection on a case-by-case basis. The schedule includes three phases: short, medium and long-term. The recommended conservation activities will include economic considerations but in some cases, restrictions on water use may strand oil resources or affect production and result in a loss of royalties. In other cases, the government may have to consider investments in research or economic instruments if elimination of existing rights to water use is to be achieved. The costs will be minimized, and the rate of reductions maximized, if government and industry work together to ensure best management of both water and hydrocarbons.

After discussing specific reduction targets, the committee concluded there is insufficient information to allow these targets to be determined except in an arbitrary manner. Instead, the committee recommends that Alberta Environment, the Alberta Energy and Utilities Board (EUB) and the oil and gas industry co-operate to consolidate the necessary data in a public database within the next three years and that Government of Alberta establish accurate targets within that timeframe. Clarification of the "water efficiency and productivity" objectives noted in the *Water for Life* strategy will provide a context for establishing targets for underground injection.

Some members of the committee wanted to declare a goal to eliminate the use of non-saline water for underground injection, starting in "water short" areas, even though it is currently unclear how this goal could be achieved. Some members advocated protecting water resources and the rights of other priority users, while enabling the continued development of Alberta's hydrocarbon resources with responsible use of non-saline water.

The committee recognizes the need for immediate action and recommends reviewing 229 *term* licences for oilfield injection, that are due for renewal, by 2005 with the intention to reduce or eliminate the allocation of non-saline water. The committee also recommends a similar review of the remaining 63 *term* licences prior to 2007.

The committee recommends the Government of Alberta and the Alberta Water Council review progress in 2007 as part of the *Water for Life* strategy and evaluate whether significant reductions in underground injection water use have occurred. Following the review, the Government of Alberta should consider whether further measures and changes are needed to ensure progress toward water reduction targets.

The following categorizes recommendations for the reduction in the use of non-saline water for underground injection. The proposed sequence of actions are outlined in the Implementation Schedule *(see page 7 of Executive Summary).*

1. Revised Regulatory Process for Underground Injection Applications and Approvals

The key recommendation of the committee is that the Government of Alberta should revise the regulatory process to address concerns about the effects of underground injection[1] activities on non-saline water. Clear and consistent criteria must be communicated to applicants and be used as a basis to manage future allocations. This process must ensure the highest standard of protection, and the most urgent conservation response, in areas where there are concerns about water supply for human or environmental requirements. The implementation of this process will immediately affect all future applications for water for underground injection and the renewal of all term licences for this purpose. It should also influence permanent licences for underground injection. The committee's recommendations are listed on the following pages.

- Alberta Environment should create a single policy document addressing water allocation for underground injection. It should identify specific (and stringent) requirements and environmental and economic criteria, which should be incorporated into a new regulatory process ("decision tree"). The revised regulatory process should be developed with stakeholders (including industry, public and government) and should establish three risk-based tiers of projects based on the location and scale of the project. The committee recommends a co-operative approach[2], based upon a previous multi-stakeholder effort to address flaring concerns.

The committee noted that the June 2002 report of the multi-stakeholder Clean Air Strategic Alliance (CASA) Flaring/ Venting Project Team[3] established a successful precedent. The CASA team recommended a decision tree process to (1) "determine if it is possible to economically eliminate or avoid flaring or venting," (2) "reduce or minimize flaring or venting" [when economic elimination is not possible]; and (3) "ensure effective performance standards." Committee members support the adoption of a similar approach to significantly reduce and eliminate (where possible) the injection of non-saline water underground, particularly where water resources are impacted or the rights of other users are threatened.

- The committee has attached a proposed concept for such a regulatory process (*see Appendix 2*). This revised process should apply to both surface and groundwater, and should apply to the entire province. The committee recommends the following three tiers:

Tier 1: Small-scale projects in isolated areas of the province. These areas should have minimal water shortage or development pressure issues.

Tier 2: Large-scale projects, including thermal ER projects, in any area of the province, and all small projects in areas with development and water allocation pressures.

Tier 3: All projects in river basins or aquifer systems with a history of water shortages and existing (or predicted) water allocation limitations.

Further work is required to define components of the decision tree process, for example, what is "large scale"?

[1] "Underground injection" includes all industrial activities noted under Purpose of the Committee on page 8.

[2] "Co-operative approach" refers to a specific approach to achieve mutual goals. Following the example of the flaring discussion, this approach would be backed up by a mandatory regulatory requirement, which would be instituted if the cooperative gains were not achieved.

[3] Clean Air Strategic Alliance, 2002. Gas Flaring and Venting in Alberta: Report and Recommendations for the Upstream Petroleum Industry by the Flaring/Venting Project Team. (See www.casahome.org).

Watershed management plans will assist in identifying these locations and issues. The highest requirement for water conservation, and the most stringent technical review, would apply to Tier 3 areas. This must be designed to protect water users in water-short areas. Reduction or elimination targets for Tier 3 will receive priority and be more stringent than in other tiers.

- The revised process should immediately apply to all new applications and to term licences on renewal. Licences should be categorized into one of the three risk-based tiers. Procedures for achieving reductions or elimination of non-saline water use should be identified within each licence review.
- For permanent licences, the committee recommends that government and industry work together to achieve significant conservation improvements.
- As an outcome of the review of term and permanent licences, the committee recommends that surpluses be returned to the Crown.

2. The Provincial Water Conservation Plan

Specific targets for underground injection should be included in the provincial Water Conservation Plan (as committed in the *Water for Life* strategy). The Plan should be developed under the scrutiny of the Alberta Water Council, in co-operation with all sectors using water, and should become a key reference document for Alberta Environment. The Plan should include specific targets for reduction or elimination of injection of non-saline water, based on analysis of existing allocations in the context of individual watersheds. The Water Conservation Plan should implement a practical approach, which promotes effective management of water resources on a watershed basis, considering the best available science.

The *Water for Life* strategy describes a province-wide, 30 per cent improvement in efficiency and productivity by 2015 that will affect all sectors. (Note: the target proposed by *Water for Life* is subject to evaluation by sectors, government and the Alberta Water Council.)

- Licence holders and the Government of Alberta should immediately begin the process of reviewing allocations and water use in order to gather data that will support the establishment of meaningful conservation targets.
- The Government of Alberta should evaluate economic instruments to support reductions in the use of non-saline water for underground injection.
- In 2007, the Government of Alberta should ensure that specific targets are established and that actions to achieve those targets are initiated.

3. Basin Water Management Plans

Water management plans should be used to determine priority locations within watersheds where every reasonable effort should be made to minimize or eliminate underground injection of non-saline water. It is important that stakeholders in these basins be involved in the process of identifying such locations (see Tiers, above). There may be immediate opportunities in some basins where water management planning is underway. (e.g., Cold Lake Beaver River Basin and South Saskatchewan River Basin.)

- The committee recommends these plans identify specific requirements about alternative sources and other issues related to underground injection, which should be considered by Alberta Environment approvals managers when making future allocation decisions.
- In areas where there are immediate or pending water deficits or conflicts, the committee recommends water users be asked to identify options that could address the deficits or conflicts.

The committee notes that the ***Water Act*** *provides for water management plans, which provide guidance on the allocation of water in each basin. The committee feels these plans must include groundwater allocation and should identify where saline water (or other sources) are available to displace non-saline water allocations for underground injection purposes. The use of water management plans for this purpose would allow consideration of local conditions, expectations and requirements. Water management plans generally include water conservation objectives, which specify the need to maintain water for the protection of the aquatic environment.*

4. Amendments to EUB Guides

Relevant EUB documents should be amended to communicate the increased importance of water conservation to applicants. These documents should provide applicants with a cross-reference to Alberta Environment's water licensing process. The EUB and Alberta Environment should work together to ensure a co-ordinated and timely process for approvals. The committee recommends the following specific changes:

- Amend *Guide 65* to include a description of a coordinated review process, linked to the process described above. This process should cross-reference Alberta Environment documents describing water conservation requirements.
- Apply EUB *Guide 7*[6] to ensure timely and accurate data are available for water production, injection and source volumes.
- Ensure Alberta Environment approval for any non-saline water use is in place before EUB approval is given for an ER project. *The processes must be co-ordinated and synchronized.*

[6] Guide 7 – Production Accounting Handbook (EUB May 2001). This guide provides the details and requirements for oil, gas and water measurement and reporting.

5. Data and Public Information

A publicly accessible database of allocation and water use information should be created. This will be an important requirement to enable Albertans to ascertain how water is allocated and used, and to facilitate conservation planning and tracking. *This recommendation is noted in Water for Life and would affect all water uses, including underground injection projects. The first step toward achieving this goal will be to ensure compatible, consistent and timely data reporting record keeping by all operators, the EUB and Alberta Environment.*

The committee recommends water resources data be improved to support comprehensive analysis and decision making during planning and licensing processes. In particular, this should include an improved provincial groundwater inventory. *This improved information is necessary to support decision making about water allocation at the local watershed and aquifer scale, and to identify areas where impacts on the water resource are likely, or circumstances where existing users are affected by underground injection (i.e. Tier 3 areas).*

The database should provide information in a form that can be readily accessed and used by regulators, municipalities and water users. The committee recognizes that this inventory will require significant time and investment.

- Alberta Environment should continue to ensure the best available science and monitoring information is used in groundwater allocation decisions and should manage aquifers conservatively. The department should continue to avoid situations where water withdrawal from aquifers could result in aquifer dewatering or depressurization.
- Alberta Environment must be given adequate resources to ensure sound knowledge and understanding of groundwater resources is obtained with initial emphasis on Tier 3 areas.

6. Industry Practices

The committee encourages industry to work with the Government of Alberta in a shared effort to achieve desirable conservation gains. The Canadian Association of Petroleum Producers (CAPP) and other industry organizations should promote best practices for water use and publicly communicate the results.

- CAPP and other industry organizations should ensure that their stewardship program addresses water management practices sufficiently.
- CAPP and other industry organizations should develop recommended practices related to underground injection and make them available to member companies and others (for example, on a website).

7. Economic Instruments

The committee recognizes there may be significant economic considerations in achieving conservation gains related to underground injection of non-saline water. It is recommended the Government of Alberta examine these economic considerations to develop direction about how they can fairly be considered in the regulatory process. Firstly, government should consider what economic instruments might be useful to encourage industry participation (e.g., cost-sharing formulae, incentives, differential fees, etc.). Secondly, the government should identify options to address situations where energy resources become stranded. (i.e. situations where the energy resources are not recoverable by other methods).

8. Research and Knowledge

The committee recommends industry, government and research groups support necessary research through the following actions:

- Work together to summarize emerging, alternate methods for ER, including timelines to commercialization and economic considerations.
- Stimulate existing and new partnerships between governments and industry to ensure alternate methods are developed and field-tested in both conventional oil and thermal ER operations. *The committee reviewed several avenues for improved research and knowledge regarding ER technology including: CO_2 injection, polymer floods, microbial floods, VAPEX, and toe-to-heel air injection.*
- Investigate the potential for further application of carbon dioxide as an alternate technology for ER.
- Review the implications of limiting the use of non-saline water in ER operations, and study options for addressing situations where energy resources may become stranded.
- Increase water conservation and recycling research for industrial waste disposal and salt cavern washing operations in order to minimize losses of water from the hydrologic cycle.

In particular, the committee notes the potential for the use of CO_2 injection in Alberta. However, it requires a significant infrastructure investment (CO_2 capture, transport, and compression). While this could prove expensive, a full accounting of economic, environmental and social factors may support such investment in some areas of the province. The committee recognized this practice does not entirely eliminate the use of water, as some water is still required for most CO_2 injection processes.

9. Public Communication

The committee recommends the following steps to help Albertans understand the actions being taken to improve water conservation practices related to underground injection:

- Alberta Environment, in co-operation with water using sectors, should develop and implement a communications plan to inform Albertans about water use amounts, licensing and monitoring processes, trends and impacts, and the Provincial Water Conservation Plan.
- Industry associations should include community relations guidelines for members in their recommended practices documents.

10. Other Considerations

The committee notes the current method of allocating water *(first-in-time, first-in-right)* was not designed to address specific concerns about water conservation and may have to be reviewed in this light in the future. As part of this review, the following questions should be addressed:

- Should there be limitations on the use of water allocation transfers for underground injection (i.e. to prevent transfers for certain purposes)?
- Should government be required to compensate underground injection operators if a water licence is suspended or cancelled to protect the aquatic environment?

The committee felt it may be important to ensure there is a test for fairness with regard to these issues but deferred discussion on these topics. In 2007, when there is a review of reductions in the use of non-saline water for underground injection, these topics and others, may become important.

Implementation Schedule

The committee's recommendations to reduce or eliminate on a case-by-case basis the use of water for underground injection are summarized in Table 1 *(see page 7, Executive Summary)*. Specifically, the committee recommends the following changes over the short, medium, and long-terms:

Phase 1: Short-Term (1-3 years)

- Develop a new regulatory process for underground injection and implement a "decision tree" that incorporates specific policy requirements and decision criteria. Categorize licences and applications using three risk-based levels (tiers).
- This new process must ensure non-saline water sources are used only when feasible alternatives do not exist, and must ensure that risk to the environment is minimized.
- Establish priorities for reduction or elimination of injection of non-saline water within each watershed, based on water availability and demand in the watershed. Minimize use of groundwater in localized areas where there are immediate or pending groundwater conflicts.

***Target:** Identify opportunities for reduction or elimination in the use of non-saline water.*

- Review 229 *term* licences, that are due for renewal, by 2005, using the new regulatory process to reduce the allocation granted by these licences, and the amount of non-saline water actually being used (i.e. replacement of non-saline water with saline water or alternate technologies). Review the remaining 63 *term* licences prior to the end of 2007.

***Target:** Reduce or eliminate, on a case-by-case basis, the amount of non-saline water used by term licence holders for underground injection activities.*

- Review 336 *permanent* licences using water for underground injection and work co-operatively with industry to determine where surplus allocations can be returned to the Crown. *The committee noted that many licence holders who hold allocations for conventional oil injection are likely to have significant surplus in their allocations as conventional oil field production diminishes.*

***Target:** Identify opportunities for reductions in allocations to permanent licence holders for injection purposes.*

- Review *permanent* licences to determine whether the actual use of non-saline water is compatible with the criteria specified in the new regulatory process and work co-operatively with industry to achieve reductions.
- Ensure water management plans currently under development address the use of non-saline water for underground injection.
- Include underground injection in the new provincial Water Conservation Plan, using 2005 as the baseline year.
- Evaluate economic instruments and incentives to reduce the use of non-saline water for underground injection. Also address situations where energy resources may become stranded.
- Improve Alberta's groundwater inventory and develop water use reporting and public information systems.
- Increase research and development on alternative sources or recovery methods.

The Government of Alberta and the Alberta Water Council should review progress in 2007 (as part of the *Water for Life* strategy) and evaluate whether significant reduction in underground injection water use has occurred. They should establish tier-specific targets that describe specific timelines for reduction or elimination of underground injection of non-saline water. Following the review, the Government of Alberta should consider further measures and changes to ensure progress toward water reduction targets is made.

Phase 2: Medium-Term (4-7 years)

- Implement tier-specific targets for reduction or elimination of underground injection of non-saline water.
- Complete the task of reviewing licences related to underground injection to identify and implement reduction opportunities and identify any action required.
- Water management planning should be initiated in any basins affected by underground injection that do not yet have a water management plan. These plans should identify the best response to "Tier 3" concerns in a multi-stakeholder setting.
- Implement conservation plans developed by industry and government.
- Implement economic instruments and/or incentives as required.
- Implement any remaining reductions identified during the short-term.
- Identify reductions in underground injection uses other than conventional enhanced recovery.
- Where water is used to dispose of industrial waste underground, or to excavate salt from underground caverns, the EUB and Alberta Environment should require reporting of the amount of water used, water sources and, where applicable, substances that are disposed. These projects should be reviewed with the objective of identifying potential conservation gains. Future allocations for these purposes should follow the new regulatory process.

***Target:** Implement reductions in other underground injection water uses by December 2011.*

The Government of Alberta and the Alberta Water Council should review reduction and conservation targets and achievements in 2011. The government should revise targets if necessary and identify any additional action required.

Phase 3: Long-Term (8-11 years)

The committee feels all initial targets for reduction or elimination of non-saline water use for underground injection should be achieved during this period. The committee recommends [the Government of Alberta (in discussion with the Alberta Water Council) evaluate the potential to establish new targets and/or new regulatory requirements.

- Evaluate regulatory process and determine if regulatory changes or further policy development are required.
- Achieve overall improvement in productivity and efficiency in Tiers 1 and 2. Achieve further reduction or elimination of underground injection of non-saline water in Tier 3 areas.
- Implement alternate technologies as appropriate including results of non-water research.
- Water management plans are developed for the entire province, each containing recommendations specific to underground injection activities.
- Achieve agreed upon target improvements in productivity and efficiency (by 2015): province-wide, all sectors.
- Measure effectiveness of economic tools and improve where required.
- Resolve situations where energy resources have become stranded.
- Adequate groundwater information is available to support water management activities.
- Water use and public reporting systems used to verify achievements.
- Review reduction and conservation targets and achievements in 2015 and identify any action required.

Beyond 10 Years

The committee expects that improved information and research will reveal new opportunities for conservation beyond 2015. These opportunities will need to be evaluated as they arise.

Conclusion

Committee members expect use of the proposed new regulatory process to improve conservation and significantly reduce or eliminate the use of non-saline water for underground injection purposes. Success will depend on the ongoing commitment and vigilance of all parties: government, industry, the Alberta Water Council, watershed planning and advisory councils, and others.

The committee believes reductions will be achieved more efficiently and economically if government and industry work co-operatively. Progress will require that legitimate holders of water rights choose to make investments for the good of the environment and society. However, if on review of the process (in 2007) the Government of Alberta (with input from the Alberta Water Council) finds that significant reductions in non-saline water use have not been made, then stronger measures such as further regulatory changes and policy development may be required.

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Appendix 1

ADVISORY COMMITTEE ON WATER USE PRACTICE AND POLICY

Brief Summary of Public/Stakeholder Response to Preliminary Recommendations

Introduction

As part of the provincial *Water for Life* strategy, the Advisory Committee on Water Use Practice and Policy (ACWUPP) was formed in Fall 2003 to review practices that permanently remove water from the hydrological cycle, including enhanced recovery of oil and bitumen (ER). The committee met seven times between October 2003 and March 2004 and submitted its preliminary report to the Minister of Environment, the Honourable Lorne Taylor, on March 31, 2004.

On April 27, 2004, Alberta Environment announced the opportunity for stakeholders and the public to review and provide their response to the committee's preliminary recommendations. In collaboration with committee members, an on-line (available through the Internet) and hard copy (available by mail or fax) survey instrument were issued to request public and stakeholder response to the preliminary recommendations of the committee. This summary describes the results of the 228 completed surveys (80 of which were received by mail or fax) and other submissions received by June 11, 2004.

The committee received and considered this summary, as well as a comprehensive list of all responses, during the development of its final recommendations. The comprehensive list of responses is available for public review by calling (780) 427-2700 *(first dial 310-0000 for toll free access)*.

Profile of Respondents

178 individuals and 50 organizations responded to the questionnaire, representing the following range of interests:

	N	%
Urban municipality	13	6%
Rural municipality	45	20%
Oil and gas industry	5	2%
Other industry	6	3%
Agriculture *(including irrigation districts)*	22	10%
Environmental interest	28	12%
Provincial government	26	11%
Interested public	83	36%
Totals	**228**	**100%**

Response to preliminary recommendations

The respondents were provided with a short statement of each of the committee's preliminary recommendations and asked whether they agreed. The following notes describe the level of agreement (among questionnaire respondents) with each preliminary recommendation. *These results should not be interpreted as statistically representative*[1].

- 88 per cent supported the need for a water conservation plan that will establish conservation targets for all sectors in Alberta, including enhanced oil recovery.
- 91 per cent agreed that applicants for water for underground injection purposes should be required to identify and assess alternatives to non-saline water sources.
- 89 per cent agreed there should be a single policy for both the Green Area and the White Area guiding water allocation for injection purposes.
- 85 per cent supported a new Water Allocation Policy for Underground Injection that includes surface water, as well as groundwater.
- 81 per cent supported the development of a "decision tree" that clearly describes to applicants and regulators the environmental, social and economic criteria required for assessing future water allocations for underground injection.
- 83 per cent agreed that Alberta Environment should, in co-operation with industry, review existing oilfield injection term licences upon expiry to identify potential conservation improvements.
- 68 per cent agreed that holders of permanent licences be asked to review reasonable and practical opportunities for reduction in non-saline water use, and make voluntary allocation adjustments. *(Note: Respondents who disagreed noted – in some cases – that this approach was too "voluntary").*
- 85 per cent agreed that there should be increased investment in research to develop alternate oil recovery technologies through industry-government partnerships.
- 90 per cent agreed that an improved database is needed to better the management of underground injection activities.
- 93 per cent agreed that investment is required to further develop a provincial inventory of groundwater resources.
- 86 per cent agreed that government, industry, and research groups should increase investment in water conservation and recycling research for industrial deep-well waste disposal and salt cavern washing operations, to minimize losses of water.
- 92 per cent agreed that an increased communications effort by government, and increased community relations efforts by industry are needed.

[1] Where respondents provided comments, some indicated that the reason they did not support a proposed action is that they wanted stronger action.

Response to additional considerations

- Respondents were asked to indicate their opinion about additional issues being considered by the committee.
- Only 37 per cent agreed that an immediate, province-wide elimination of underground injection of non-saline water is not reasonable because of current technical and economic considerations. *57 per cent did not see why immediate elimination is not feasible.*
- 71 per cent agreed the committee should propose long-term elimination of injection of non-saline water. *Industry and business organizations who responded did not support this goal because they felt that universal "elimination" is unlikely to be a feasible goal. They support increased protection of the resource and of other high priority users, but question why an economically valuable use of water would be eliminated in situations where it is not creating a problem.*
- 82 per cent agreed that the transfer rights of licence holders using water for underground injection should be reviewed.

Other Submissions

The committee also received written submissions from other organizations responding to the preliminary report. Overall, the comments received in these letters complimented the results of the questionnaire, but also offered specific suggestions on how this issue should be addressed while considering economic, environmental and/or social factors.

The following organizations provided written responses to the committee:

- Environmental Law Centre
- Mountain View Regional Water Services Commission
- Canadian Association of Petroleum Producers
- Alberta Energy and Utilities Board
- Calgary Chamber of Commerce
- Alberta Chamber of Resources
- Alberta Urban Municipalities Association
- Athabasca Tribal Council

General perceptions of the recommendations

The following statements describe responses that give some insight into the overall perceptions of the preliminary recommendations:

72 per cent agreed that the recommendations should increase emphasis on water conservation and strengthen the regulatory process while respecting the economic implications to the province.

Only 47 per cent* of respondents agreed that the recommendations in the preliminary report were a practical and effective response to the concerns raised by Albertans.

* Many respondents who said "no" included notes to indicate they thought the recommendations did not go far enough toward elimination of the use of non-saline water.

Appendix 2

ADVISORY COMMITTEE ON WATER USE PRACTICE AND POLICY

Proposed "Decision Tree" Guideline: Alternatives to Non-Saline Water for Underground Injection

Introduction

This "Decision Tree" is a component of Alberta Environment's proposed *"Water Allocation Guideline for Oilfield Injection Purposes (2004)."* The policy is currently under development as a revision of the previous *"Groundwater Allocation Policy for Oilfield Injection Purposes (1990)."*

Figure A2.1 shows the industry ER fluid selection process. Figure A2.2 shows the regulatory process for the EUB and Alberta Environment outlining the different pathways an application may follow. The decision tree provides the details necessary for a company to complete an application, and guidelines for regulators in reviewing and making a decision.

In general, the "Decision Tree" is expected to:

- *Eliminate* the use of non-saline water in ER projects where reasonable and feasible alternatives exist.
- *Reduce* the use of non-saline water over time at existing ER projects through periodic re-evaluation of alternatives and through continuous improvement efforts.
- *Increase productivity* of non-saline water use by expanded use of *recycling, reuse* and *tertiary ER methods* that will maximize the oil or bitumen recovered for each barrel of non-saline water used.
- *Minimize impacts* on the aquatic ecosystem and other water users.
- *Minimize groundwater use* in areas with immediate or pending groundwater conflicts or uncertainties.

Five Essential Regulatory Steps

The five essential steps for "authorization" of any ER scheme will include:

1. *Rigorous technical evaluation by industry* (alternate water source evaluation).
2. *Industry application to Alberta Environment* for non-saline water licence, if needed. EUB technical assistance on alternative water sources review may be requested
3. *Alberta Environment Licence Decision* (includes EUB, industry, public stakeholder consultation). Includes Environmental Appeal Board procedures if needed to resolve water licence issues.
4. *EUB Technical Review* of ER scheme.
5. *EUB Decision and Authorization of ER Scheme* following issuance of Alberta Environment licence or other water use authorization, if applicable.

Periodic Re-evaluation

Re-evaluation using the above noted five steps will occur at five-year intervals for every new project, if non-saline water is still needed after the initial two-year term of the non-saline water licence. Possible reductions in allocation volumes will also be reviewed at term renewal.

Rigorous Technical Evaluation

A rigorous technical evaluation of every ER project will be required, including detailed, consistent assessment of alternative water sources, as well as environmental and economic considerations, by professional parties (geoscientists, engineers, economists etc), and evaluation by professional scientific staff of the EUB and Alberta Environment.

Risk-based Categories and Regional Considerations

A key aspect of the Guideline will be identification of three categories ("Tiers") of increasingly intensive requirements for investigation of alternate ER fluids or ER methods, and more rigorous evaluation criteria, depending on the degree of water shortage and development pressure on non-saline water resources (see the proposed Risk-based Assessment Framework, attached). This place-based categorization includes technical, social, environmental and economic criteria that require increasing efforts to replace the use of non-saline surface or groundwater in areas where development pressures and water allocation limitations are severe.

- *Tier 1:* Small-scale projects in isolated areas of the province, these areas should have minimal water shortage or development pressure issues.
- *Tier 2:* Large-scale projects, including thermal ER projects, in any area of the province, and all small projects in areas with development and water allocation pressures.
- *Tier 3:* All projects in river basins or aquifer systems with a history of water shortages and existing (or predicted) water allocation limitations. Watershed management plans will assist in identifying these locations and issues.

The tiers will be further defined and communicated so that all parties understand requirements and the appropriate decision process. The responsible Alberta Environment Director will evaluate the environmental and economic criteria and select from the relevant "tier" the requirements appropriate to each project, with input from industry, EUB staff and the guidance of Water Management Plans, Guidelines, and Policies appropriate to the licensing process.

Figure A2.1: Industry Decision Tree for ER Fluid Selection

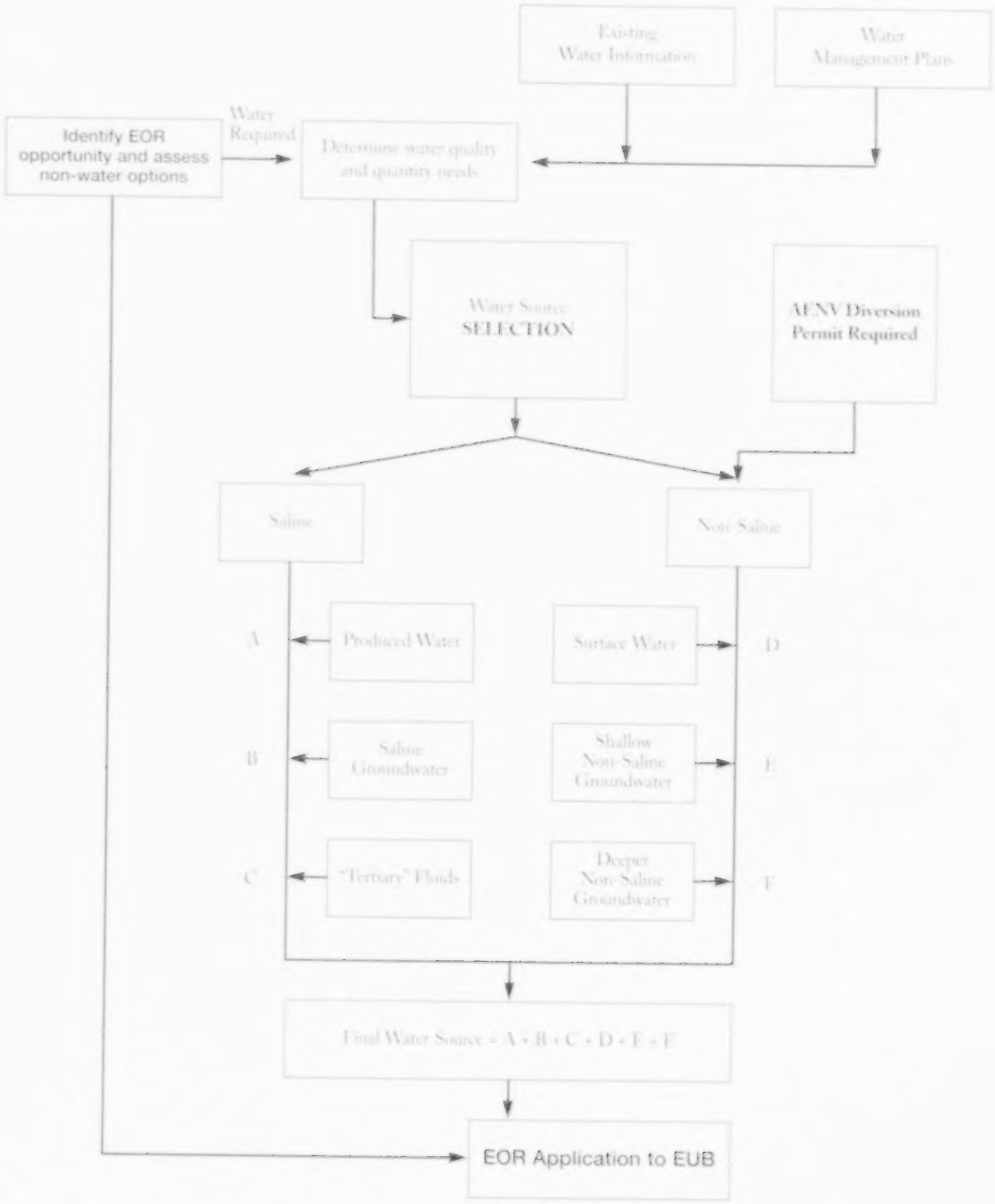
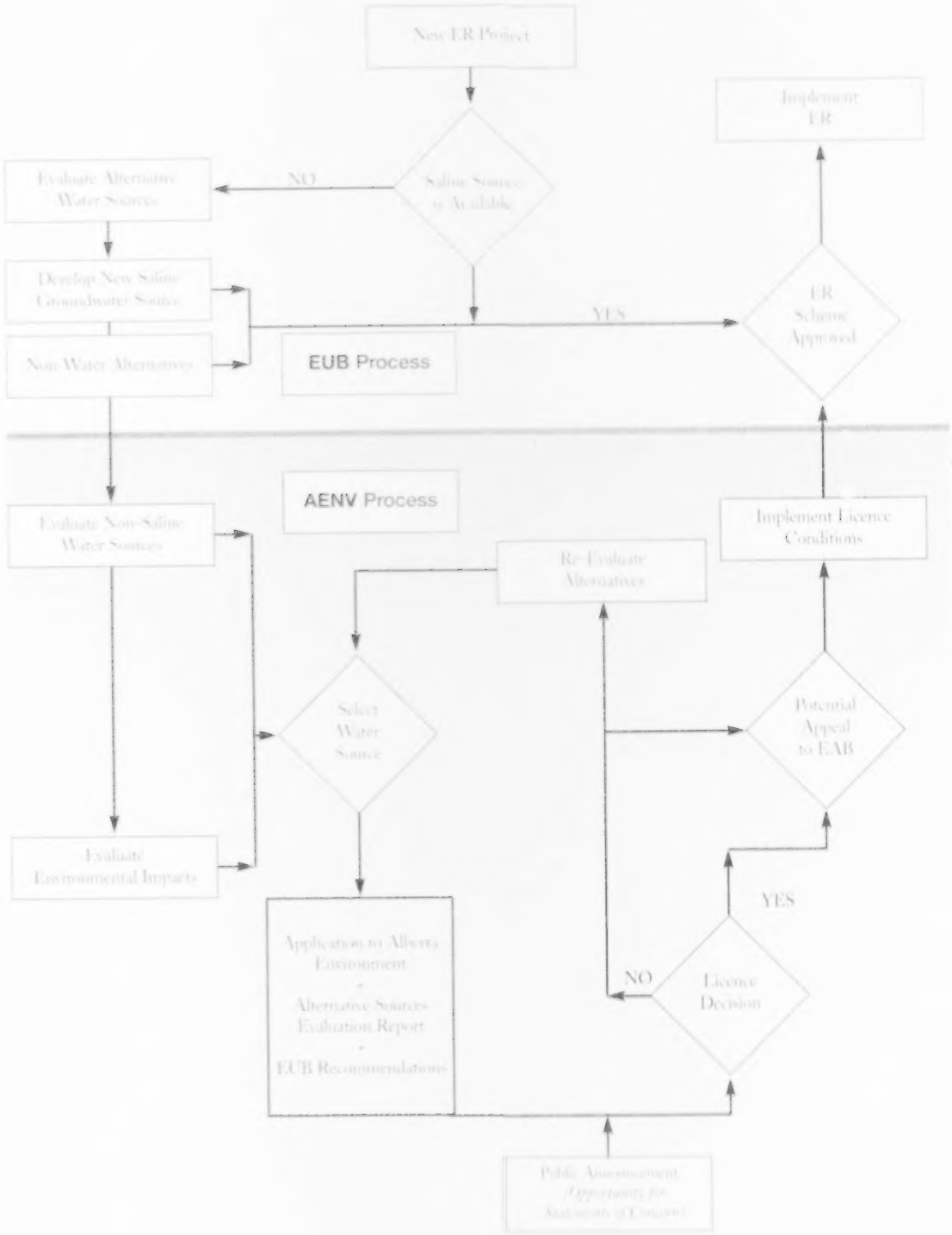
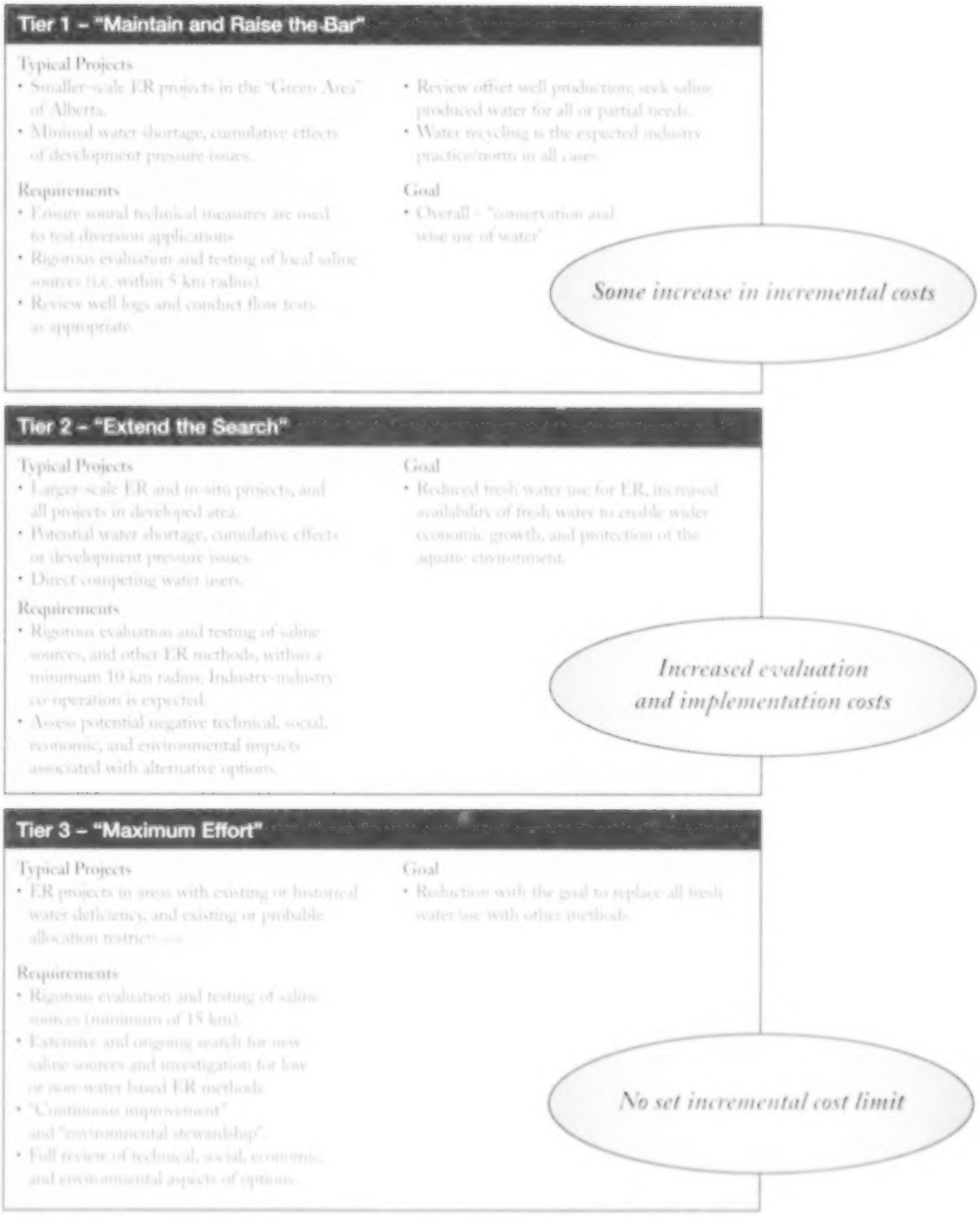


Figure A2.2 Government Authorization – Decision Tree



Proposed Risk-Based Assessment Framework


Tier 1 – "Maintain and Raise the Bar"
Typical Projects
• Smaller-scale ER projects in the "Green Area" of Alberta.
• Minimal water shortage, cumulative effects of development pressure issues.
Requirements
• Ensure sound technical measures are used to test diversion applications.
• Rigorous evaluation and testing of local saline sources (i.e. within 5 km radius).
• Review well logs and conduct flow tests as appropriate.
• Review offset well production; seek saline produced water for all or partial needs.
• Water recycling is the expected industry practice/norm in all cases.
Goal
• Overall – "conservation and wise use of water"
Some increase in incremental costs
Tier 2 – "Extend the Search"
Typical Projects
• Larger-scale ER and in-situ projects, and all projects in developed area.
• Potential water shortage, cumulative effects or development pressure issues.
• Direct competing water users.
Requirements
• Rigorous evaluation and testing of saline sources, and other ER methods, within a minimum 10 km radius. Industry-industry co-operation is expected.
• Assess potential negative technical, social, economic, and environmental impacts associated with alternative options.
Goal
• Reduced fresh water use for ER, increased availability of fresh water to enable water economic growth, and protection of the aquatic environment.
Increased evaluation and implementation costs
Tier 3 – "Maximum Effort"
Typical Projects
• ER projects in areas with existing or historical water deficiency, and existing or probable allocation restrictions.
Requirements
• Rigorous evaluation and testing of saline sources (minimum of 15 km).
• Extensive and ongoing search for new saline sources and investigation for low or non-water based ER methods.
• "Continuous improvement" and "environmental stewardship".
• Full review of technical, social, economic, and environmental aspects of options.
Goal
• Reduction with the goal to replace all fresh water use with other methods.
No set incremental cost limit

notes

For addition information on the Advisory Committee on Water Use Practice and Policy, please visit www.waterforlife.gov.ab.ca/html/removed.html

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